INTRACRANIAL NEURECTOMY AND REMOVAL OF THE GASSERIAN GANGLION.

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WITHIN the past few years intracranial excision of portions of the fifth nerve, together with removal, more or less complete, of the Gasserian ganglion, has been done for the cure of intractable trigeminal neuralgia.

The credit of first doing such an operation rests with Rose, of London, after whom is to be mentioned Novaro, Horsley, Andrews, Krause and others. Hartley, in the *New York Medical Journal* of March 1, 1892, published his method, and related a case successfully operated on. He has published a more full account of the same, with diagrams and cases, in the ANNALS OF SURGERY for May, 1893. It is as follows:

> An omega-shaped incision was made, having its base at the zygoma and measuring a distance marked by a line drawn from the external angular process of the frontal bone to the tragus of the ear.
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> The curved and rounded portion of this incision reached as high as the supratemporal ridge, the diameter of said circle being three inches. The skin and deeper tissues were cut in the shape of the Greek capital letter omega. This incision was carried down to the periosteum of the skull in all portions of the incision, except in the straight part of the base; the tissues were then retracted and the periosteum divided upon the bone in the same direction as far as the straight part at the base. (Fig. 1).
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> With a chisel a groove was cut in the bone corresponding to the divided periosteum. This groove went to the vitreous plate, except at the upper angle over the rounded portion, where it included the vitreous plate.
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> A periosteum elevator was here inserted and used as a lever to

snap the bone on a line between the ends of the circular portion of the incision. In this way the breakage occurs along the lower portion of the wound, and a flap, consisting of skin, muscle, periosteum and bone, is thrown down, exposing the dura mater over a circular area of three inches in diameter. The middle meningeal artery was tied, the dura mater separated from the bone, and the floor of the middle fossa of the skull was exposed. Broad retractors were used to raise the dura mater with the brain, and to expose the foramen rotundum and the foramen ovale. The hæmorrhage was stopped by sponge pressure. The exposure of the first, second and third divisions of the fifth nerve, together with the carotid artery and cavernous sinus was exceedingly good.

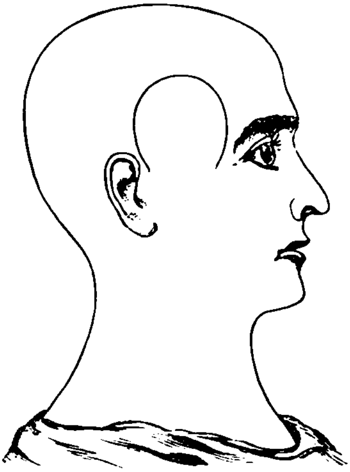

FIG. 1.—Showing Hartley's omega incision.

The second and third divisions were isolated at the foramen rotundum and the foramen ovale, and by slight pressure upon the dura mater, it could be stripped from the nerves to beyond the Gasserian ganglion. These were divided with a tenotome at the foramen rotundum and the foramen ovale, and that part between these and a point beyond the Gasserian ganglion was excised. As this amount of nerve is not very great, the ends of the nerves were pushed through the two foramina so as, if possible, to interfere with any reunion. In the retraction of the dura mater, owing to imperfect instruments, the third, fourth and sixth nerves were somewhat injured. As no bleeding was present, the brain was allowed to fill the fossa. The flap—consisting of bone, periosteum, muscle and skin—was replaced. The irregular edge of the vitreous plate which remained attached to the bone not involved in the flap, acted as a shelf on which the flap rested, and prevented its falling in upon the dura mater. The periosteum was stitched, the muscle sutured in place, and the skin sewn with silk. One drainage tube was inserted at the lower angle; an antiseptic dressing was applied. Time of operation, one hour and forty minutes; the patient was carried to the ward in good condition. The disadvantage was the inability to resect as long a piece as could be done in some of the other methods.

It has been my fortune to operate four times for excision of intracranial portions of the fifth nerve. In each case the reason for the operation was trigeminal neuralgia, not due to disease of the brain. Hartley's method was followed. An account of each instance is appended, together with an examination into the present condition of the three patients who can be reached. All cases recovered from the operation, and were relieved of neuralgia, it is to be hoped, permanently.

CASE I.—Mrs. ——, aged fifty-nine, came under my care in September, 1892, suffering with right facial neuralgia, and gave the following history:

Pain began fourteen years ago in the right upper jaw nerve. The intermissions were complete and of varied length, months sometimes intervening between paroxysms. On June 10, 1890, the second division of the fifth was divided at the infra-orbital foramen. The scar of this operation is visible. For two years complete relief was obtained. Then the paroxysms returned with great vigor. For several months the patient had been unable to talk without bringing on severe paroxysms, had been unable to swallow, laugh, or to use the face muscles in any way; so much so was this the case that she carried a tablet on which to write, instead of speaking; she avoided solid food, and took only liquids. Her condition was one of very great suffering almost all the time; even when as quiet as possible agonizing attacks of pain came on.

The second and third divisions of the fifth were affected, cheek, lips, tongue, gums, palate, and especially the auriculo-temporal region.

September 8, 1892, the operation was done in the usual way. The middle meningeal artery was torn in separating the flap of bone, and was ligated by passing a thread on a curved needle through the dura. On turning down the flap of bone, the opening in the skull was found to be not large enough and gave insufficient room, so more bone was bitten away with forceps. There was an escape of cerebro-spinal fluid from the aperture made in the dura at the time of wounding the artery. The second and third divisions of the nerve, together with the Gasserian ganglion, were well exposed to view. The nerves, and so much of the ganglion as seemed to be attached to the nerves, were removed, and the distal ends of the nerves tucked into their respective foramina. The bone was not replaced when the flap was put in position. A piece of silver wire, bent on itself, was laid at the posterior angle of the skin wound, so as to permit drainage if required. A voluminous dry dressing was then applied. The flow of cerebro-spinal fluid was so great during the first twenty-four hours as to necessitate on two occasions that a folded sheet under the head should be changed; in twenty-four hours the cotton and gauze dressing was replaced by a dry one. This was again necessary on the second and on the third day, although the flow of fluid was less, when the wire was removed. Stitches were removed on the seventh day. Pain ceased from the moment of operation, and the patient had an uninterrupted recovery. No disturbance to the eye in any way was noted, and the patient was soon able to return to her usual life. The patient has no teeth, they having been extracted several years ago, in hope of relieving the pain.

An examination of this patient thirteen and a half months after the operation shows as follows:

Motion of tongue unimpaired; the muscles of mastication are paralyzed. This did not appear to be so immediately after the operation. There are no trophic changes in the skin to which the divided portions of the nerve are distributed; it is not shiny or red. Sensation on the face is wanting in the area shown on the accompanying figure by the shading. (Fig. 2).

Outside the area of complete loss of sensation there is uncertain sensation.

The front part of the tongue and the antero-lateral (right) aspect is without sensation, but a touch is recognized just in front of the circumvallate papillæ. The hard palate is without sensation. The soft palate is indistinctly sensitive. The mucous lining of the cheek in its anterior part is without sensation; further back sensation is present. Heat and cold are recognized in portions of the tongue where ordinary sensation is wanting. Taste on the tongue is not interfered with.

The method of investigating taste was as follows: The tongue was drawn beyond the lips, and securely held. Its surface was then dried with a soft rag, and a drop of warm water, containing sugar or salt in solution, was put on the part of the tongue entirely without sensation, either of general touch, of heat or cold. Almost instantly the patient was able to tell whether sugar or salt was put on her tongue, and this, of course, without drawing the tongue into the mouth, but while the tongue was firmly held outside the lips.

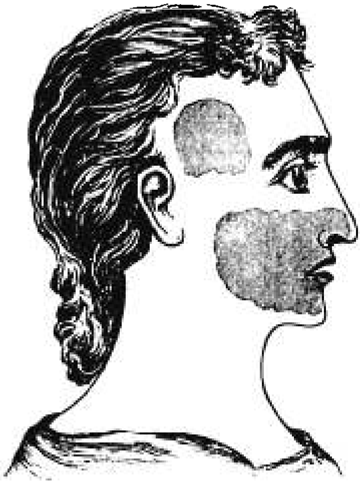

FIG. 2.—Showing areas of anæsthesia resulting in Case I.

The patient states that the tongue is now more sensitive than it was at first; she complains of a feeling as though the gum and cheek of the affected side were covered with India rubber. She chews on the left side, for occasionally food which is being eaten gets into the right cheek, and it is necessary to press it back into the mouth with the hand. This, however, occurs but seldom.

The right occipito-frontalis is not paralyzed, nor is the corrugator supercilii. The patient wears without discomfort the same set of false teeth that she wore before the operation. Slight pulsation under the flap. Temple concave.

CASE II.—B., aged sixty-seven, male, has been operated on for neuralgia of the second division of the fifth, right side, several times. The nerve has been cut away at the infra-orbital foramen ; then more deeply, and finally Carnochan's operation was done. Temporary relief was afforded after each operation, but the pain subsequently returned.

In February, 1893, I divided the middle division of the fifth, intracranial, but did not divide the third division, as the patient had not suffered from neuralgia of this branch. Recovery was uneventful, and he went out of the hospital in three weeks.

I have not been able to see him since he left hospital, and therefore his present condition is unknown to me.

(The artery was torn as in the first case, and required to be tied.)

CASE III.—Miss ——, in her seventy-ninth year, gives the following history: Pain in the second division of the fifth nerve, on the right side, began in 1863. The pain was not great and occurred rarely at intervals during several years. The intermissions became shorter and the pain more marked. In the third division pain was noticed several years later. The pain became progressively worse and worse. At the present time the pain in the lips and gums and tongue is most intense.

The patient sits with the mouth open lest the lips should touch each other; holds the lips as still as possible; does not move the tongue; allows the saliva to dribble from the mouth because the pain in swallowing it is so great. This pain is not in the throat itself, but is referred to the tongue, lips and side of the cheek. She has had no teeth extracted on account of neuralgia; one of the very few cases about whom this can be said. Yawning is impossible on account of pain, which is referred to the lower jaw joint. She has taken no solid food for some years, and has lived on soft toast, soft eggs, tea, etc. There is on right side hyperæsthesia of the face, and the skin is rough and coarse, The condition of the patient was most distressing. She had been subjected to no operation, and had borne her sufferings as best she could.

I operated in the usual way, June 30, 1893, notwithstanding the patient's advanced age. She seemed active and strong, and I did not think her number of years should prevent my affording relief, if I was able so to do.

The middle meningeal artery was not divided. When the second division of the nerve was exposed at the base of the skull, I stripped the dura from it as usual. There was a gush of cerebrospinal fluid, which subsequently welled up quite clear until, perhaps, two ounces were sponged away. The second and third divisions of the nerve and the Gasserian ganglion were then exposed, excised, and the nerve ends pushed back into their respective foramina.

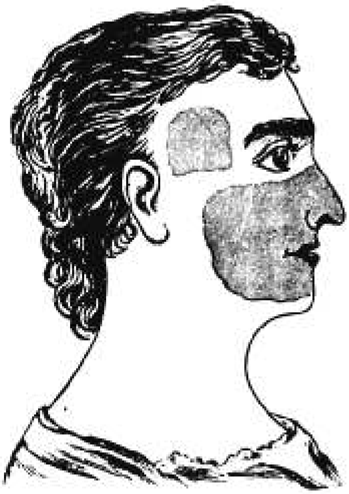

FIG. 3.—Showing areas of anæsthesia in Case III.

The wound was closed as usual, and a dry dressing applied, which was changed on the eighth day. Recovery was uneventful; relief from pain absolute.

Examination four months after the operation reveals anæsthesia of the face, as shown in the diagram by the shading. (Fig. 3).

Outside the area of complete anæsthesia there exists a zone of irregular sensation, in which the difference between heat and cold is plainly recognized, but ordinary sensation is wanting. The tongue, in its right lateral half, as far back as it can be touched, is anæsthetic. So also the inside of the cheek, and the hard and soft palates.

Taste.—Sugar and salt are plainly recognized on the anterior portion of the tongue where anæsthesia exists.

The muscles of mastication are paralyzed. The right anterior half of the occipito-frontalis is paralyzed; also the right corrugator supercilii, doubtless from division of the branch from the seventh by the superficial wound. Electricity shows degenerative reaction.

There is no pulsation to be recognized under the flap. Temple concave. A slight touch on the teeth in either the lower or upper jaw of this patient is felt distinctly. The harsh, rough skin has become smooth and fair, and the face has become that of a placid and contented woman.

Dr. F. T. Miles examined this case with me.

CASE IV.—Mrs. S., aged forty-six, a widow, came under my care in 1882, suffering from neuralgia of the third division of the fifth.

In the body of the lower jaw I chiselled the bone and excised one inch of the nerve. The wound healed at once and complete relief was obtained, which lasted thirteen months.

She then consulted me again, suffering pain in the lower lip, tongue, in the auriculo-temporal region, and in the territory supplied by the second division of the fifth.

Prior to the first operation she had been subject to neuralgia for six or seven years, diffused over the side of the face, which was localized only within a few months of the time when she first consulted me. Paroxysms now came on very frequently, and they were excited by movement, by touching the face, or without apparent exciting cause. The skin over the affected area became bright red during a paroxysm of pain.

September 25, 1893, I performed the usual operation. The meningeal artery was not interfered with. As the brain seemed somewhat in my way, I raised the dura and opened it, thus permitting cerebro-spinal fluid to escape, which gave me much more room. So the exposure and removal of the nerves and ganglion became easy. A bit of bent wire was laid at the posterior angle of the wound, and removed with the first dressing, Some blood, but no cerebro-spinal fluid, escaped into the dressing.

On the sixth day after the operation the patient put her hand by the side of her eye and scratched the wound under the dressing which she said itched very much. This irritated the wound somewhat, and on removing the dressing two days thereafter I found some redness at the point where she had scratched it. The dressings were changed and stitches removed, and everything went well.

Present condition: Pain entirely relieved. Anæsthesia of the face is shown in the diagram by the shading. (Fig. 4).

The right half of the tongue, hard and soft palates, gums, and inside of left cheek are anæsthetic, but not extending so far back as in the previous cases.

The replaced bone is firm and strongly in position. The right half of the occipito-frontalis is paralyzed, as also the corrugator supercilii. The anterior extremity of the omega incision is hyperæsthetic. There are no trophic changes in the anæsthetic area. The muscles of mastication are paralyzed. The difference between heat and cold is not recognized in the anæsthetic territory. Taste within the mouth, the patient says, is the same as always, but the difference between salt and sugar is not recognized when applied on the tongue held beyond the lips. The conjunction of the right eye is slightly anæsthetic. The right nostril is not so sensitive as the left to the smell of ammonia.

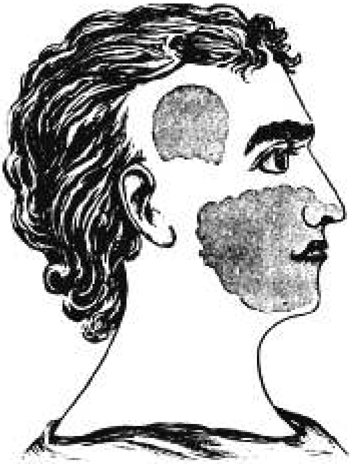

FIG. 4.—Showing areas of anæsthesia in Case IV.

While the method pursued in all of my cases was not entirely that indicated by Hartley, it varied from it so little as properly to be classed as instances of his operation.

The skin incision has been as his; the division of the skull I have made with chisel, also using strong forceps. I have not found that the bone always broke as low down as I would wish it, and so have not hesitated to remove additional bone with forceps. Whether the bone is replaced or not does not affect the healing of the wound.

In two of the four cases the middle meningeal artery was divided while making the bone flap, and was tied by passing a single silk ligature through the dura proximal to the tear by means of a curved needle.

I have noted that when first opening the head the brain seemed to fill the cavity and the dura appeared tense; this is due to the presence of cerebro-spinal fluid, as well demonstrated in the two last cases.

In the last case I did not, therefore, hesitate to puncture the dura and evacuate the fluid, after which, the patient being on the opposite side, the brain was found to lie quite away from the field of operation, and the dura mater rested wrinkled on the surface of the brain, as a sheet loosely thrown over a bed. Thus ample room was afforded for uncovering the nerves and exposing the ganglion. This observation was to me extremely interesting.

In uncovering the nerves I begin with the second division. Having uncovered it, I pass a ligature around it with a long aneurism needle having a short curve; then strip the dura from it backwards, reaching the third division and the ganglion.

With the same needle I pass a ligature around the third division. Making gentle traction on the ligatures, with a long, sharp curette I am able to separate the nerves and take away the adjacent portion of the ganglion, and then make my section of the nerves at the round and oval holes. In this way I do not attempt to take away all the ganglion. I exposed and recognized the first division, but left it alone, for there was no reason why it should be disturbed.

In certain cases hitherto reported, trouble with the eye, ptosis, etc., has been reported. In none of my cases has any disturbance of nutrition or function of the eye been apparent. I attribute this to the method already referred to for isolating the nerves and the ganglion, and confining the operation exclusively to them.

The operations have been long, but recovery in each instance has been rapid and complete. In all cases the wounds healed at once, except the fourth, where the patient scratched the recent wound and infected it.

It is worthy of note, very suggestive for the future, that in the case of the patient upon whom operation was performed fourteen months ago there is less anæsthesia and more perverted sensation than in the other cases. Sensation seems to have returned somewhat, and it is interesting to speculate as to whether sensation will ever completely return, and if so, by what route.

Preservation of the sense of taste, after division of the second and third divisions, is to be noted.

That the power to recognize heat and cold exists in a region rendered devoid of ordinary sensation by nerve section is of much interest, and recalls an observation made some time since that a conjunctiva insensitive from the local application of cocaine still appreciates the difference between heat and cold.

When dividing the third division of the nerve in Case 4, I believe that I isolated and recognized the motor branch before dividing it. Not having provided myself with a sufficiently long and fine electrode, I could not prove the accuracy of my opinion by electric stimulation, and therefore divided everything.

By leaving intact the motor branch the patient would not have food collect in the cheek of the paralyzed side, and in future operations an effort should be made towards this end.